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preglacial times, since in the subsequent erosion it has been removed from many parts of the serpentine belt. The details of this decomposition of the serpentine and of its relation to glacial erosion have been discussed by the writer in an essay on rock decay, to appear in the *American Journal of Science* for September, 1883. He acknowledged in conclusion his obligations to Dr. Britton for his careful description and for his personal guidance on Staten island.

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A CLASSIFICATION OF THE NATURAL SCIENCES.[1]

BY T. STERRY HUNT, LL.D, F.R.S.

TO frame a rational classification of the natural sciences, and to define their mutual relations, has often been attempted. The present writer, in an essay read before the National Academy of Sciences in 1881, and published in the *L. E. & D. Philosophical Magazine* under the title of "The Domain of Physiology," suggested the basis of such a scheme, and now, at the suggestion of some of his readers, ventures to embody in a concise and tabulated form the views then and there enunciated, in the hope that other students may find it not unworthy of their notice.

The study of material nature, or of the physical universe (for the terms natural and physical are synonymous), constitutes what the older scholars correctly and comprehensively termed physics, and presents itself in a two-fold aspect; first, as descriptive, and second, as philosophical; a distinction embodied in the terms natural history and natural philosophy, or more concisely in the words physiography and physiology. The latter word has, from the time of Aristotle, been employed in this general sense to designate the philosophical study of nature, and will be so used in the present classification.

The world of nature is divided into the inorganic or mineralogical and the organic or biological kingdoms, the divisions of the latter into vegetable and animal being a subordinate one. The natural history or physiography of the inorganic kingdom takes cognizance of the sensible characters of mineral species, and gives us descriptive and systematic mineralogy, which have hitherto been restricted to native species, but in a wider sense include all artificial species as well. The study of native mineral species, their aggregations, and their arrangement as constituents of our planet, is the object of geognosy and physical geography. The physiography of other worlds gives rise to descriptive astronomy.

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[1] Read in general session at Minneapolis meeting of A. A. A. S., Aug., 1883.

The natural philosophy of the inorganic kingdom, or mineral physiology, is concerned, in the first place, with what is generally called dynamics or physics, including the phenomena of ordinary motion, sound, radiant energy, electricity and magnetism. Dynamics in the abstract regard matter in general, without relation to species; chemism generates therefrom mineralogical, or so-called chemical species, which, theoretically, may be supposed to be formed from a single elemental substance or *materia prima.* Dynamics and chemistry build up the inorganic world, giving rise to the science of geogeny and, as applied to other worlds, to theoretical astronomy.

Proceeding to the organic kingdom, its physiographic study leads us first to organography and then to descriptive and systematic botany and zoölogy, two great sub-divisions of natural history. Coming now to consider the physiological aspects of organic nature, we find besides the dynamical and chemical activities manifested in the mineral kingdom, other and higher ones which characterize the organic kingdom. On this higher plane of existence are found portions of matter which have become individualized, exhibit irritability, the power of growth by assimilation, and of reproduction, and moreover establish relations with the external world by the development of organs; all of which is foreign to the mineral kingdom. These new activities are often designated as vital, but since this term is generally made to include at the same time manifestations which are simply dynamical or chemical, I have elsewhere proposed for the activities characteristic of the organism the term biotics (Greek *βιοτικος*, pertaining to life).

The physiology of matter in the abstract is dynamical, that of mineral species is both dynamical and chemical, while that of organized forms is at once dynamical, chemical and biotical. The study of the biotical activities of matter leads to organogeny and morphology, while the relations of organisms to one another, and to the inorganic world, gives rise to physiological botany and physiological zoölogy. We thus attain to a comprehensive and simple scheme of the natural sciences, which I have endeavored to set forth in the subjoined table:

NATURAL SCIENCES.	INORGANIC NATURE	ORGANIC NATURE.
DESCRIPTIVE. General Physiography or Natural History.	MINERAL PHYSIOGRAPHY. Descriptive and Systematic Mineralogy; Geognosy; Geography; Descriptive Astronomy.	BIOPHYSIOGRAPHY. Organography; Descriptive and Systematic Botany and Zoölogy.
PHILOSOPHICAL. General Physiology or Natural Philosophy.	MINERAL PHYSIOLOGY. *Dynamics or Physics:* *Chemistry.* Geogeny; Theoretical Astronomy.	BIOPHYSIOLOGY. *Biotics.* Organogeny; Morphology; Physiological Botany and Zoölogy.

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EDITORS' TABLE.

EDITORS: A. S. PACKARD, JR., AND E. D. COPE.

—— Without doubt a most serious objection to the study of natural history, in the minds of young people and also older amateurs, is the technical language used by specialists. Nomenclature, botanical and zoölogical, is the *pons asinorum* of those who are not always dull in intellect, or who have even a smattering of Latin and Greek. Technical words, however, are necessary for brevity and conciseness of expression, and for use in a polyglot science.

Changes in nomenclature are also a great evil, vexing the amateur mind most sorely. But by the application of the law of priority and holding specialists to binomial names, we shall after awhile arrive at a reasonable amount of uniformity. The late Professor Wyman abominated excessive nomenclature, and used to declare his belief that specific and generic names should be abolished and species, at least, numbered 1, 2, 3, etc.

But now comes a new source of vexation to the lay biologist. We refer to the use of lower-case initials in writing the generic name, either alone or coupled with the specific name, with an initial in lower-case type. While certain ornithologists are to be condemned for using a cumbersome trinomial nomenclature, certain entomologists and editors adopt the usage of librarians and bibliomaniacs and write *Turdus migratorius*, *turdus migratorius*. We have of late years, for the sake of uniformity with English and German writers (though much against our will), written specific names derived from proper names in lower-case initials, and